

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A liquid crystal display device comprising:

a first substrate;

a second substrate;

a liquid crystal layer disposed between the first substrate and the second substrate;

and

a plurality of picture element regions each defined by a first electrode provided on a face of the first substrate facing the liquid crystal layer and a second electrode provided on the second substrate so as to oppose the first electrode via the liquid crystal layer sandwiched therebetween,

wherein the first electrode includes a plurality of openings and a solid portion in each of the plurality of picture element regions,

the liquid crystal layer is in a substantially vertical orientation state in each of the plurality of picture element regions when no voltage is applied between the first electrode and the second electrode, and

when a voltage is applied between the first electrode and the second electrode, a plurality of liquid crystal domains ~~each in a radially inclined orientation state~~ are formed in the plurality of openings and the solid portion by inclined electric fields generated at

respective edge portions of the plurality of openings of the first electrode, for producing a display by changing orientation states of the plurality of liquid crystal domains in accordance with the applied voltage, and

wherein each of said liquid crystal domains includes: (a) first liquid crystal molecules oriented substantially parallel to a normal of the first substrate thereby defining an axis, and (b) second liquid crystal molecules existing around all lateral sides of said axis and radially inclined relative to the axis.

2. (Original) The liquid crystal display device of Claim 1, wherein at least some of the plurality of openings have substantially the same shape and the same size, and form at least one unit lattice arranged so as to have rotational symmetry.

3. (Original) The liquid crystal display device of Claim 2, wherein each of the at least some of the plurality of openings is in rotationally symmetrical shape.

4. (Original) The liquid crystal display device of Claim 2, wherein each of the at least some of the plurality of openings is in a substantially circular shape.

5. (Original) The liquid crystal display device of Claim 2, wherein each region of the solid portion surrounded with the at least some of the plurality of openings is in a substantially circular shape.

6. (Original) The liquid crystal display device of Claim 2, wherein each region of the solid portion surrounded with the at least some of the plurality of openings is in a substantially rectangular shape with substantially arc-shaped corners.

7. (Original) The liquid crystal display device of Claim 1, wherein, in each of the plurality of picture element regions, a total area of the plurality of openings of the first electrode is smaller than an area of the solid portion of the first electrode.

8. (Original) The liquid crystal display device of Claim 1, further comprising a protrusion within each of the plurality of openings,

wherein a cross-sectional shape of the protrusion taken along a plane direction of the substrate is the same as a shape of the corresponding opening, and

a side face of the protrusion has an orientation-regulating force for orienting liquid crystal molecules of the liquid crystal layer in the same direction as an orientation-regulating direction obtained by the inclined electric field.

9. (Original) The liquid crystal display device of Claim 1, wherein the plurality of liquid crystal domains are in a spirally radially-inclined orientation state.

10. (Original) The liquid crystal display device of Claim 9, further comprising a pair of polarizing plates respectively provided outside of the first substrate and the second substrate and disposed with polarizing axes thereof crossing each other substantially perpendicularly,

wherein, in each of the plurality of liquid crystal domains, assuming that a liquid crystal molecule included in the liquid crystal layer and positioned in a 12 o'clock direction on a display surface in regard to a center of each of said plurality of liquid crystal domains is inclined against the 12 o'clock direction on the display surface by an angle θ , the polarization axis of one of the pair of polarizing plates is inclined in the same direction as inclination of the liquid crystal molecule positioned in the 12 o'clock direction on the display surface by an angle exceeding 0 degree and smaller than 2θ against the 12 o'clock direction on the display surface.

11. (Original) The liquid crystal display device of Claim 10, wherein the polarization axis of one of the pair of polarizing plates is inclined by an angle exceeding 0 degree and equal to θ or less.

12. (Original) The liquid crystal display device of Claim 10, wherein the polarization axis of one of the pair of polarizing plates is inclined by an angle substantially the same as $\theta/2$.

13. (Original) The liquid crystal display device of Claim 10, wherein the polarization axis of one of the pair of polarizing plates is inclined by an angle substantially the same as θ .

14. (Original) The liquid crystal display device of Claim 1,
wherein the solid portion includes a plurality of island portions arranged in the form of an $m \times n$ matrix and a plurality of branch portions for electrically connecting adjacent pairs of the plurality of island portions, and
the number of the plurality of branch portions is smaller than $(2mn - m - n)$.

15. (Original) The liquid crystal display device of Claim 1,
wherein the first substrate further includes an active element provided correspondingly to each of the plurality of picture element regions, and
the first electrode corresponds to a picture element electrode provided in each of the plurality of picture element regions to be switched by the active element and the second electrode corresponds to at least one counter electrode opposing the plurality of picture element electrodes.

16-17. (Canceled)

18. (Currently amended) A liquid crystal display device comprising:

a first substrate;

a second substrate;

a liquid crystal layer disposed between the first substrate and the second substrate;

and

a plurality of picture element regions each defined by a first electrode provided on a face of the first substrate facing the liquid crystal layer and a second electrode provided on the second substrate so as to oppose the first electrode via the liquid crystal layer sandwiched therebetween,

wherein, in each of the plurality of picture element regions, the liquid crystal layer is in a substantially vertical orientation state when no voltage is applied between the first electrode and the second electrode, and the first electrode includes a plurality of openings and a solid portion,

at least some of the plurality of openings have substantially the same shape and the same size, and form at least one unit lattice arranged so as to have rotational symmetry,
and ~~The liquid crystal display device of Claim 16,~~ wherein each ~~[[a]]~~ region of the solid portion surrounded with at least some of the plurality of openings is in a substantially circular shape.

19. (Currently amended) A liquid crystal display device comprising:

a first substrate;

a second substrate;

a liquid crystal layer disposed between the first substrate and the second substrate;

and

a plurality of picture element regions each defined by a first electrode provided on a face of the first substrate facing the liquid crystal layer and a second electrode provided on the second substrate so as to oppose the first electrode via the liquid crystal layer sandwiched therebetween,

wherein, in each of the plurality of picture element regions, the liquid crystal layer is in a substantially vertical orientation state when no voltage is applied between the first electrode and the second electrode, and the first electrode includes a plurality of openings and a solid portion,

at least some of the plurality of openings have substantially the same shape and the same size, and form at least one unit lattice arranged so as to have rotational symmetry,
and

~~The liquid crystal display device of Claim 16,~~ wherein each [[a]] region of the solid portion surrounded with at least some of the plurality of openings is in a substantially rectangular shape with substantially arc-shaped corners.

20. (Currently amended) The liquid crystal display device of Claim [[16]]18, wherein the solid portion includes a plurality of island portions arranged in the form of an

m x n matrix and a plurality of branch portions for electrically connecting adjacent pairs of the plurality of island portions, and

the number of the plurality of branch portions is smaller than $(2mn - m - n)$.

21. (New) The liquid crystal display device of Claim 1, wherein the liquid crystal layer includes a liquid crystal material having negative dielectric anisotropy.

22. (New) The liquid crystal display device of Claim 18, wherein the liquid crystal layer includes a liquid crystal material having negative dielectric anisotropy.

23. (New) The liquid crystal display device of Claim 19, wherein the liquid crystal layer includes a liquid crystal material having negative dielectric anisotropy.

24. (New) A liquid crystal display device comprising:

a first substrate;

a second substrate;

a liquid crystal layer disposed between the first substrate and the second substrate;

and

a plurality of picture element regions each defined by a first electrode provided on a face of the first substrate facing the liquid crystal layer and a second electrode provided

on the second substrate so as to oppose the first electrode via the liquid crystal layer sandwiched therebetween,

wherein the first electrode includes a plurality of openings and a solid portion in each of the plurality of picture element regions,

the liquid crystal layer is in a substantially vertical orientation state in each of the plurality of picture element regions when no voltage is applied between the first electrode and the second electrode,

the solid portion of the first electrode includes a plurality of unit solid portions each substantially surrounded with at least some of the plurality of openings,

when a voltage is applied between the first electrode and the second electrode, a liquid crystal domain is formed in each of the plurality of openings and each of the plurality of unit solid portions by inclined electric fields generated at respective edge portions of the plurality of openings of the first electrode, and

wherein at least one of said liquid crystal domains includes: (a) first liquid crystal molecules oriented substantially parallel to a normal of the first substrate thereby defining an axis that is substantially normal to the first substrate, and (b) second liquid crystal molecules existing around all lateral sides of said axis and radially inclined relative to said axis.

25. (New) A liquid crystal display device comprising:
a first substrate;

a second substrate;

a liquid crystal layer disposed between the first substrate and the second substrate;

and

a plurality of picture element regions each defined by a first electrode provided on a face of the first substrate facing the liquid crystal layer and a second electrode provided on the second substrate so as to oppose the first electrode via the liquid crystal layer sandwiched therebetween,

wherein the first electrode includes a solid portion formed from a conducting film and a nonsolid portion in which a conducting film is not formed in each of the plurality of picture element regions,

the liquid crystal layer is in a substantially vertical orientation state in each of the plurality of picture element regions when no voltage is applied between the first electrode and the second electrode,

the solid portion of the first electrode includes a plurality of unit solid portions each substantially surrounded with the nonsolid portion,

when a voltage is applied between the first electrode and the second electrode, a liquid crystal domain is formed in each of the plurality of unit solid portions by inclined electric fields generated at respective edge portions of the nonsolid portion of the first electrode, wherein the liquid crystal domain includes first liquid crystal molecules oriented substantially parallel to a normal of the first substrate thereby defining an axis

that is substantially normal to the first substrate, and second liquid crystal molecules existing around all lateral sides of said axis and radially inclined relative to said axis.

26. (New) The liquid crystal display device of Claim 1, wherein the liquid crystal display device is a transmission/reflection combination type liquid crystal display device.

27. (New) A liquid crystal display device comprising:

a first substrate;

a second substrate;

a liquid crystal layer disposed between at least the first substrate and the second substrate; and

a plurality of picture element regions, each including a first electrode supported by the first substrate facing the liquid crystal layer and a second electrode supported by the second substrate so as to oppose the first electrode,

wherein, in at least one of the picture element regions:

the first electrode includes a solid portion and a plurality of separate spaced apart openings defined in the solid portion, so that each of the openings is surrounded on all lateral sides by the solid portion,

wherein, in an absence of voltage between the first electrode and the second electrode in said picture element region, at least a substantial portion of the liquid crystal

layer in said picture element region includes liquid crystal molecules in a vertical orientation state,

when substantial voltage is applied between the first electrode and the second electrode in said picture element region, inclined electric fields are generated proximate respective edge portions of the plurality of openings defined in the solid portion of the first electrode in a manner so that said inclined electric fields cause a plurality of liquid crystal domains to be formed in the picture element region, so that a different liquid crystal domain is formed for each of the openings defined in the solid portion of the first electrode and at least one liquid crystal domain is formed over a solid portion of the first electrode between a pair of openings, and

wherein each liquid crystal domain for a corresponding opening defined in the solid portion of the first electrode includes liquid crystal molecules which are inclined and symmetrically oriented around all lateral sides of a vertical domain axis (SA) located in the corresponding opening, and wherein at least one liquid crystal molecule along the vertical domain axis (SA) at each openings is oriented in a vertical state when the substantial voltage is applied and wherein at least some liquid crystal molecules on opposite sides of the vertical domain axis (SA) for each opening are inclined in opposite directions.

28. (New) A liquid crystal display device comprising:
a first substrate;

a second substrate;

a liquid crystal layer disposed between at least the first substrate and the second substrate; and

a plurality of picture element regions, each including a first electrode supported by the first substrate facing the liquid crystal layer and a second electrode supported by the second substrate so as to oppose the first electrode,

wherein, in at least one of the picture element regions:

the first electrode includes a solid portion and a plurality of separate spaced apart openings defined in the solid portion, so that each of the openings is surrounded on all lateral sides by the solid portion,

wherein, in an absence of voltage between the first electrode and the second electrode in said picture element region, at least a substantial portion of the liquid crystal layer in said picture element region includes liquid crystal molecules in a vertical orientation state,

when substantial voltage is applied between the first electrode and the second electrode in said picture element region, inclined electric fields are generated proximate respective edge portions of the plurality of openings defined in the solid portion of the first electrode in a manner so that said inclined electric fields cause a plurality of liquid crystal domains to be formed in the picture element region, so that a different liquid crystal domain is formed for each of the openings defined in the solid portion of the first

electrode and at least one liquid crystal domain is formed over a solid portion of the first electrode between a pair of openings, and

wherein each liquid crystal domain for a corresponding opening defined in the solid portion of the first electrode includes liquid crystal molecules which are inclined and oriented around all lateral sides of a vertical domain axis (SA) located in the corresponding opening.

29. (New) The liquid crystal display device of claim 25, wherein an orientation of the liquid crystal domain and an orientation of the liquid crystal layer in the nonsolid portion are mutually continuous.

30. (New) The liquid crystal display device of claim 25, wherein the first electrode includes a plurality of openings defined therein, and wherein at least some of the plurality of openings have substantially the same shape and the same size, and form at least one unit lattice arranged so as to have rotational symmetry.